MEDRAD®

Veris™ 8600
Patient Monitoring System

Service Manual

Veris™
MR MONITORING SYSTEM

p/n 3010798 Revision 0
Date 09/05

CE 0123

2 Main Monitor Maintenance and Checkout

This section contains recommended procedures for maintenance, and an operational checkout of the MEDRAD ***Veris*** patient monitor. Routine maintenance and inspection will:

- Ensure continued performance of the patient monitor system.
- Reduce the possibility of equipment malfunction.

Incoming Inspection

You must inspect patient monitors coming back from service for shipping damage before you place them into operation just like newly purchased patient monitors. The patient monitor should be free from dents, cracks, or other physical damage.

If further incoming inspection or testing is required, the manufacturer recommends that you use the Alarms Verification (located in this section) as an incoming inspection test. You can perform additional electrical safety testing in this section as part of an incoming inspection in accordance with the policies of the health care provider.

Maintenance Schedule

Every Patient	• Clean and disinfect the sensor cables and sensor. • Inspect the accessories and cables for damage. • Change the gas sampling device and sampling line. • Check the NIBP function. • Change the water trap
Every Day	• Charge the batteries as necessary. If not using the monitor on a patient, keep it plugged into the power supply for continuous charging. • Test the NIBP function.
Every Week	• Charge the ECG module battery.
Every 3 Months	• Clean the exterior of the unit (or clean as needed). • Fully charge the batteries.
Every Year	• Perform the annual safety tests. • NIBP calibration and safety tests. • Verify the CO_2 and agent gas calibration.

MEDRAD also recommends that a complete system calibration and performance checkout be performed annually. Contact MEDRAD Factory Service or your local MEDRAD office for complete details.

In the United States, Canada, Japan, and Europe, the MEDRAD Service Department offers Preventive Maintenance Programs. These annual programs greatly assist in maintaining accuracy and reliability, and can also extend the life of the system. COntact MEDRAD for details. In Europe, contact your local MEDRAD office or your local authorized dealer for further information. Refer to "MEDRAD Subsidiaries" on page 1-1 and "International Offices" on page 1-2 for address, telephone, and FAX information.

NOTE: Failures which occur due to a lack of proper maintenance will not be covered under warranty.

Monitor Safety Testing

You can perform the following tests as part of a periodic safety check. If the monitor fails any portion of these tests, contact MEDRAD.

The contents of this section include the following verifications and safety tests:

- Electrical Leakage
- Interface Inspection
- Manual Controls Check
- Alarm Verification
- Vital Sign Modules Verification
- ECG
- SpO_2
- NIBP
- IBP
- Temperature
- Gas Flow/CO_2/O_2
- Communications

Repaired modules could require more extensive testing than what is shown in this list.

Always follow ESD precautions when performing a procedure discussed in this section.

⚠WARNING⚠

- Because test procedures require working with exposed electrical circuits, only experienced electrical or biomedical technicians should perform the procedures.
- After a monitor is altered through repair or hardware adjustment, you must fully test it before use.

Equipment and Tools

The following procedures assume that the technician has an ESD safe workbench, a set of electronic hand tools, and a digital multimeter with a 10 amp setting. At the beginning of each test, special equipment can be listed. A variety of customized cables, clips, and test fixtures are also needed to complete the tests. For more information, contact MEDRAD.

Accessory Testing

Check the electrical safety of the power cord as part of the patient monitor safety testing.

Cleaning and Disinfecting

⚠WARNING⚠

- Shock Hazard! Before cleaning the patient monitor, turn the power off and disconnect the AC power cable.
- Shock Hazard! Never immerse the patient monitor because the patient monitor has an internal power source that is active even when the unit is unplugged.

Do not use abrasive cleaners on the patient monitor or on any sensors or probes. Abrasive cleaners damage the patient monitor.

With the exception of the display screen, wipe clean the exterior surface of the patient monitor with alcohol. Dry it with a soft, dry cloth. Because paper towels or tissues can scratch the surface of the display, use a cotton cloth to clean the patient monitor.

Do not use full-strength alcohol on the display screen. Repeated use of strong cleaners damages the screen. Clean the display window by wiping it clean with a soft, lint-free cloth sprayed with common glass cleaner, however, do not spray glass cleaner directly on the display.

Accidental Wetting

⚠WARNING⚠

- Shock Hazard! Because a patient monitor is an AC-powered device, an immersed patient monitor presents a danger to anyone who attempts to handle the device.

Immediately perform the following steps following an accidental wetting of equipment:

1. Turn the power off. Disconnect AC power from the patient monitor.
2. If the monitor is monitoring a patient, transfer the patient to another monitor as quickly as possible.
3. Use a clean, dry towel or cloth to remove the liquid from the patient monitor housing.
4. A service technician should inspect the patient monitor as soon as possible.
5. If the internal mechanism is saturated, allow the liquid to drain out for 24 hours before shipping.
6. If liquid has entered the patient monitor, it must be dried and cleaned internally. Full testing is required before you can use the monitor. Contact MEDRAD as soon as possible.

Time is critical. The longer any liquid remains in the patient monitor, the more damage it can do. It is important to service the patient monitor immediately after any liquid is spilled into it.

Battery Safety

The batteries require no maintenance. For more information, refer to the *MEDRAD **Veris** 8600 Patient Monitor Operator's Manual.*

⚠CAUTION⚠

- Do not short circuit the battery terminals! The resulting high-current discharge can cause burns.
- Charge the battery completely after extended battery use to ensure a fully-charged battery is available for the next use.
- Explosion hazard! Keep lighted cigarettes, sparks, and flames away from the battery.
- The battery contains sulfuric acid electrolyte that can cause severe burns and eye damage, as well as illness from sulfur oxide fumes.
- Do not crack, cut, burn, or dissolve (with solvents) the battery case. Damaging the battery case can cause the release of sulfuric acid. If sulfuric acid is released from the battery, wear eye protection and rubber gloves to handle the battery, and use a solution of baking soda in water to neutralize the sulfuric acid.
- Do not incinerate the batttery. The used battery is a potential environmental hazard and must be disposed of properly. Dispose of the old battery in accordance with local and federal laws.

Long-Term Monitor and Battery Storage

No special preparation is necessary for long term storage of the monitor. Although you do not have to remove the battery from the monitor for long term storage, the battery drains to an unrecoverable state after 3 months without periodic charging.

Monitor and Accessories Disposal

At the end of its useful life, you can dispose of the monitor and its accessories according to your institution's policies and procedures for disposal of patient-contact medical waste.

Alternately, you can return the monitor and its accessories to MEDRAD, Inc., for safe disposal. The shipping address is:

MEDRAD, Inc.
One Medrad Drive
Indianola, PA 15051-0780 USA

Fuse Replacement

There are two AC power fuses located at the AC input side of the power supply directly above the AC power entry socket. See the fuse specifications for the proper fuse.

1. Pry the cover from the fuse well above the AC cord.
2. Gently remove the fuse assembly and remove the spent fuse(s).
3. Replace fuses and reassemble in reverse order.

Electrical Safety Testing (Main Monitor)

Perform this test each time you open the patient monitor housing and before you use the monitor on patients.

⚠WARNING⚠

- Shock Hazard! Because dangerous and lethal voltages are present during the withstanding voltage, leakage, and ground continuity test, all leakage and voltage testing must be done with the monitor housing in place. For complete information about the proper operating and safety procedures, refer to the ***Veris*** *8600 Patient Monitor Operator's Manual.*

Leakage Test Equipment and Setup

Perform all testing with the cover on. The following test requires a Dynatech 232D leakage tester or equivalent.

1. Perform a self-test, if applicable, on the DYNATECH 232D by plugging it into 110 VAC outlet. Turn on the leakage tester. Set the mode switch to self test. Display should read 1000 ±20 and the *CURRENT SOURCE ACTIVE* lamp should be on.

⚠CAUTION⚠

- If these conditions are not met, do not continue with this test.

2. Set the mode switch on the Dynatech 232 to L1-L2 (line voltage). The display should read the line voltage ±10%. Set the mode switch to L1-GND. The display should read no more than 5% of L1-L2 on a grounded power system. Set the mode switch to L2-GND.

   NOTE: This should read about the same as the L1-L2 reading for a grounded system.

Leakage Test Procedure

The monitor must be powered up during all of the isolation tests.

1. Turn the mode switch to EARTH CURRENT LEAKAGE. Connect the AC cord from the Dynatech 232D to the monitor, and turn on the unit. With the POLARITY switch in the NORMAL position, press OPEN GROUND and monitor the readout for less than 0.25 mA at 120VAC.
2. Change the polarity switch to the REVERSE position, press OPEN GROUND and monitor the meter for less than 0.25 mA at 120VAC.
3. With the POLARITY switch in the NORMAL position, press OPEN NEUTRAL and OPEN GROUND switches and monitor the meter for less 0.25 mA at 120VAC.
4. Change the POLARITY switch to the REVERSE position and press the OPEN NEUTRAL and OPEN GROUND switches and monitor the meter for less than 0.25 mA at 120VAC.
5. *Cardiac and Anesthetic models only:* Connect an IBP ground leakage cable to a brown lead of the leakage tester. Turn the LEADS selector switch to the ISO position. Turn the POLARITY switch to NORMAL, press the ISO TEST button, and monitor the meter for less than 20 microamps. Verify IBP current leakage is less than 0.020mA.

Functional Testing

Interface Inspection

This procedure is for the monitor's TFT active display.

1. Verify that a readable screen displays. For a guide to proper screen layout, refer to the ***Veris** 8600 Patient Monitor Operator's Manual* for sample screens.
2. Verify that the screen display is clear and bright when you directly face the patient monitor.
3. Verify the image quality. There should be no intermittence or jittering of pixels. The maximum amount of pixels missing from any display are as follows:
   - Maximum number of bad dots allowed per screen is 7.
   - Maximum number of bad dots within any 20mm radius circle is 1.

Manual Controls Check

1. Verify that rotating the menu knob moves the cursor through the menu items. Verify that when you press the menu knob on a highlighted menu item the monitor displays a sub-menu.
2. Use the menu knob to enter the *CONFIG* window and set the date and time for the real time clock.
3. Press the FREEZE key. Verify that you get an audible response from the speaker. Press the FREEZE key again to unlock the waveforms.
4. Press the TREND key. Verify that you get an audible response from the speaker. A *Trend* window appears on the display. Press the TREND key again to close the *Trend* window. (Or optionally, press and hold the TREND key to open the *TYPE/INTERVAL/ SCREEN* menu that you close by selecting *EXIT*.)
5. Press the STAND BY key. Verify that you get an audible response from the speaker. A standby confirmation menu or *ALARM STANDBY MODE* message should appear. Press the STAND BY key again to return to the screen.
6. Press the DEFAULT key. Verify that you get an audible response from the speaker. The *Custom Default* menu appears. Select *NO* and then select *EXIT* to return to the *Main* window.
7. Press the NIBP CYCLE/STAT key. Verify an audible response from the speaker. The *NIBP STAT/Cycle Time* menu appears. Choose *EXIT* to return to the *Main* window.
8. Press the NIBP key. Verify an audible response from the speaker and that the NIBP pump runs. Press the NIBP key again to cancel the reading.
9. Press the PRINT key. Verify an audible response from the speaker.

   NOTE: Since no printer is present, nothing should happen. The audible response verifies that the key is functional.
10. Press the SILENCE Key. Verify an audible response from the speaker and that a silence symbol appears in the top, right hand corner of *Waveform 1*.

Fiber Optic Communication

This test is for units with a remote display. If the ***Veris*** patient monitor does not have a remote display, skip this test.

To verify fiber optic communication:

1. Enter the *CONFIG* menu and select *ENTER NETWORK CONFIG.*
2. Enter the password (MEDRAD) to enter, then click on *Yes.*
3. Set to the following:
   - Sync Type: Fiber Optic
   - IP Address: 192.168.000.*xxx*
   - Net Mask: 255.255.255.000
   - Port: 02571
   - Channel Type: Peer-to-Peer
   - Channel: X
   - SSID: Any
4. Select *Exit* to effect changes.
5. Re-cycle the power to save the setting.
6. Turn on a test ***Veris*** remote display set to *Fiber Optic.* Verify communication.
7. Use the encoder to verify that the screen on the remote display replicates what is present on the main monitor.
8. Press the PRINT key on the main monitor and verify that the remote display prints data.

Alarms Verification

To verify the alarm circuitry for SpO_2, perform the following procedure.

1. In the *PARAMS* window turn off all monitoring modules except for SpO_2. Set the display to show a plethysmograph waveform.
2. In the *PARAMS* window set the *SpO2 Low Limit Alarm* setting to *HIGH.* This sets the alarm priority for only this alarm parameter.
3. Use an SpO_2 simulator to set the monitor to display the plethysmograph waveform. Confirm the heart rate reading appears in the HR parameter box and the saturation reading appears in the SpO_2 parameter box.
4. In the *ALARMS* window adjust the SpO_2 low alarm level above the saturation reading to cause an alarm condition.
5. Verify that the message *LOW SPO2* appears at the top of the waveform channel in red letters.
6. Verify that you get an audible response. The alarm should be a high priority alarm tone consisting of 3 beeps followed shortly by two beeps.
7. In the *PARAMS* softkey window, change the *SpO2 Low Limit Alarm* setting to *MEDIUM.*
8. Verify that the message *LOW SPO2* appears at the top of the waveform channel in yellow letters.
9. Verify that you get an audible response. The alarm should be a medium priority alarm tone consisting of 3 beeps.

ALARM VOLUME TEST

1. From the *ALARMS* window, vary the *Alarm Volume* through the ranges, from *1* to *10.* Verify that the speaker volume changes according to the setting of the *Alarm Volume.*
2. Press the alarm SILENCE key once. Verify that the low heart rate alarm stops for 2 minutes and that the 2-minute *Alarm Silence* symbol appears in the top, right hand corner of Waveform 1.
3. Press and hold the alarm SILENCE key for at least 2 seconds. Verify that the low heart rate alarm stops and the infinity *Alarm Silence* symbol appears in the top, right hand corner of Waveform 1.

Module Verification

NIBP Verification

The NIBP verification requires Dynatech Nevada NIBP Analyzer. Connect the 8600 monitor to a Dynatech Nevada NIBP Analyzer set for the following operation.

NIBP Analyzer Settings
Adult 120/80 (90); Heart Rate 80 bpm
Neonate 80/50 (62); Heart Rate 80 bpm
Pressure Adjustments: Gain 100%; Shift 4

1. Use the T-connection with a small adult or adult cuff for these tests. Wrap the cuff around the monitor's pole. Connect the cuffs to the 0-300 mmHg port of the NIBP analyzer.
2. Connect the monitor to an AC (mains) power source and turn on the monitor.
3. Press and hold down the monitor's NIBP CYCLE/STAT key. The monitor's cycle time window appears.
4. Select the *NIBP Cycle Time* to two minutes.

120/80 OPERATION SETTING

1. In the monitor's *ADM/DIS* window set the *Patient Size* to *Adult* mode.
2. Connect the NIBP hose to the fitting on the monitor.
3. Press the NIBP key.
4. Allow the monitor to take at least four (4) readings. Calculate the average of the four (4) readings and verify that each reading does not vary by more than ±4% or ±4mmHg (whichever is greater) from the calculated average. Each reading shall not vary more than 8 mmHg from the simulator setting.
5. Recalibrate the monitor if necessary.

80/50 OPERATION SETTING

1. Set the monitor to the *Neonate* mode. Use a Neonate cuff wrapped around a post on the tray.
2. To verify *STAT* mode operation, press and hold the NIBP CYCLE/STAT key.
3. Allow the monitor to take at least four (4) readings. Calculate the average of the 4 readings and verify that each reading does not vary by more than ±4% or ±4mmHg (whichever is greater) from the calculated average. Each reading shall not vary more than 8 mmHg from the simulator setting.

SpO_2 Verification

The following test requires a SmartSat SpO_2 analyzer and an 8-pin serial test connector with a BNC connection at one end.

1. Verify that the message *SPO2: NO SENSOR* appears when there is nothing connected to the SPO2 connector.
2. Verify that the message *SPO2: SENSOR* appears when you plug the finger sensor in, but without a finger actually inserted into the sensor.
3. Verify that the message *SPO2: HIGH AMBIENT* appears by introducing a higher than normal amount of ambient light on the SpO_2 sensor detector. Verify the message disappears within 10 seconds after you remove the ambient light.
4. Place the SpO_2 finger sensor on an index finger and verify that the heart rate and plethysmograph operation display on the LEDs within 15 seconds. Verify that SpO_2 error messages do not appear (alarm violations can occur depending on individual readings and monitor set-up).
5. Select *Pleth* in a waveform setting in the *DISPLAY* menu. Verify the LCD displays a plethysmograph waveform. Connect the 8-pin serial test cable to the monitor: the 8-pin connector to COM2 on the monitor and the BNC connector into an oscilloscope channel. In the *CONFIG* window, scroll to *ANALOG OUT SELECT*, then select *PLETH*. Use the SpO_2 finger sensor to verify that the SpO_2 waveforms appear on the scope. The waveform should be centered on 0 volts and register 1 volt peak-to-peak. Remove the SpO_2 cable.
6. Verify that the pulse tone increases as you change the tone from *1* to *10* in the *Alarm Setting* window.
7. Use an optical load to simulate a small signal and verify that the message *SPO2: SEARCH or LOST* appears after search delay time ± 5 seconds. (An optical load that can be used for this test is a foam peanut used for packing.)
8. Enter the *DISPLAY* screen and change the SpO_2 waveform size to *x2* and *x4* and verify the scale change on the display for each setting. Return size setting to *x1*.
9. Connect a Smart Sat SpO_2 simulator and verify the readings are within the acceptable tolerance found in the "Smart Sat Procedure" on page 2-11.

Smart Sat Procedure

Equipment needed:

- SmartSat SS-100A or equivalent pulse oximetry analyzer

1. Turn on the pulse oximetry analyzer. Press F1 (Sp02 Sim) and then F2 (AutoSeq) to access the Programmable AutoSequence Directory.
2. Press F1 (Select↑) or F2 (Select↓) to select the file "CSI 1". When the file has been selected press F5 (Run) to begin the program.
3. Insert the SpO_2 cable from the pulse oximetry analyzer in to the unit to be tested.
4. Turn on the monitor to be tested. Press F1 (Start) on the pulse oximetry analyzer to begin the simulation.
5. Verify the monitor stabilizes within the limits given for each level. Use Smart Sat Auto Sequence "CSI 1".

Level	SpO_2	Limits	Heart rate	Limits
1	99%	97 - 99%	40 bpm	39-41 bpm
2	96	94 – 98	60	59-61
3	90	88 – 92	80	79-81
4	78	76 – 80	100	99-101
5	61	58 – 64	120	119-121
6	52	49 – 55	180	179-181
7	40	37 – 43	300	297-303

6. If the ***Veris*** monitor fails only 1 level, rerun that level using the manual mode of the pulse oximetry analyzer.
   a. Press PREV (2) times and then F1 (Manual).
   b. Press F4 (Change+), and F5 (Change-) to manually set the SPO2 %.
   c. Press F3 (-->Select) to select pulse rate. Press F4 (Change+), and F5 (Change-) to manually set the PULSE RATE (BPM).
   d. Allow 30 seconds for the readings to settle. If the readings settle within the given limits, pass the monitor.

SpO_2 Gating Verification

1. Connect a gating test cable to the GATING connector on the monitor.
2. Enter the *PARAMS* menu and set *Gating* to *SpO2 Pulse*.
3. Verify that the gating output matches the heart rate frequency.

ECG Verification

This test requires a Dynatech Nevada Model 300 simulator.

NOTE: For Base and BasePlus models, begin with step 5.

1. Select the *PARAMS* menu to set up for *ECG PARAMS* to *5-Lead, ECG ON*, Filters: *MONITOR, SENSITIVITY* to *HIGH.*
2. Insert a shorted ECG cable into the ECG connector. Use the menu knob to enter the *DISPLAY* window. Set the following and use the current defaults for the size. They are 25MM except waveform 1:
   - Waveform 1 ECG I x 4.0 25.0
   - Waveform 2 ECG II x 4.0 25.0
   - Waveform 3 ECG V x 4.0 25.0
3. Exit the *DISPLAY* window. Verify that the baselines are centered. Verify that the base line signal is no greater than 3 pixels in height. Select the most solid line as the reference line and verify that this reference is less than ±3 pixels from the ECG y-axis center line. Remove the shorted cable.
4. Verify that the message *LEADS OFF* appears at the top of the window when a cable is not connected.
5. Connect the 3-lead ECG patient cable to the ECG cable assembly, and use a Dynatech Nevada Model 300 simulator to turn on (ECG) normal sinus, 60BPM, amp 1.0mV, axis int. Respiration rate 20, and the impedance set for 0.5 ohms, and base impedance for 2K. Set the "Lead select" on the simulator to Lead II.
6. Rotate the menu knob to select *PARAMS* and press to enable the menu. Select for *ECG Cable: 3 lead*). Set the monitor for *LEAD II* waveforms. Check the following lead configurations for the following items:
   - Heart rate 60 ±3 BPM,
   - *RESPIRATION RATE* of 20 ±2 breaths per minute and
   - Correct waveform.

ECG Gating Verification

1. Enter the *PARAMS* menu and set *Gating* to *ECG Pulse*.
2. Set the ECG simulator to normal sinus and heart rate to 60bpm. Connect a modified gating cable from the GATING connector on the monitor to an oscilloscope and verify that the frequency of the output matches the input BPM.

IBP Verification

The main focus of the following steps is the MED SIM 300 (or its equivalent). This is only for monitors with IBP (Cardiac and Anesthetic models).

1. Attach the IBP cable from **BP1** on the simulator to **IBP 1** on the monitor's connector panel.
2. Select BP on the simulator. Select **Channel 1**. Select **STAT**. Select **ZERO** by using the up and down arrows on the MED SIM 300, scroll through the menu until *STAT* appears and press to select.
3. Rotate the rotary encoder knob to highlight *PARAMS* and move down to *IBP1*. Press the menu knob once. Set the *SITE* for *ART*.
4. Press the rotary encoder knob again. Adjust the *RANGE*. This should be set for *0-200*. Press the rotary knob until you reach *IBP1* again.
5. Exit out of *PARAMS*. Use the rotary encoder knob to scroll to select the *IBP1 ZERO* selection on the display. Observe that a *0* (zero) appears on the screen next to the line that contains *ART (---/---(0) MMHG*.
6. Return to the Medsim and select *WAVE* and execute. Select *ART* for *ARTERIAL* and press *EXE* to execute the function. Observe the waveform on the screen. Verify that the pressure reads 120/80 ±2MMHG.
7. Attach the IBP cable from **BP2** on the simulator to **IBP 2** on the monitor's connector panel.
8. Select BP on the simulator. Select **Channel 1**. Select **STAT**. Select **ZERO** by using the up and down arrows on the MED SIM 300, scroll through the menu until *STAT* appears and press to select.
9. Rotate the rotary encoder knob to highlight *PARAMS* and move down to *IBP2*. Press the menu knob once. Set the *SITE* for *CVP*. Press the rotary encoder knob again. Adjust the *RANGE*. This should be set for *0-20*. Press the rotary knob until you reach *IBP2* again.
10. Exit out of *PARAMS*. Use the rotary encoder knob to scroll to select the *IBP2 ZERO* selection on the display. Observe that a *0* (zero) appears on the screen next to the line that contains *CVP (0) MMHG*.
11. Return to the Medsim and select *WAVE* and execute. Select *CVP* and press *EXE* to execute the function. Observe the waveform on the screen. Verify that the pressure reads 12 ±1MMHG.

7. Use the Electrode status error messages on the monitor display to perform a lead off check in LEAD II.

(LL) Red	LEAD OFF
(LA) Black	LA LEADS OFF
(RA) White	RA LEAD OFF

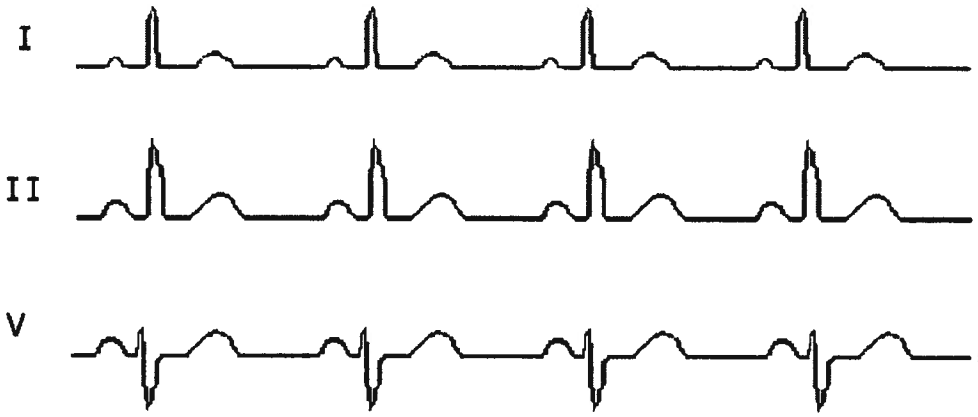
NOTE: This completes the ECG Verification for Base and BasePlus models. Continue with the Electrical Safety tests.

8. Connect all the leads back on the simulator and select *ECG Cable* to *5-lead*. Set the monitor for LEAD I waveforms. Verify that the following messages appear and lead switching occurs as each lead is disconnected one at a time (reconnect the cable to eliminate the message and return the waveform):

(V1) Brown	V LEADS OFF	
(LL) Red	LEADS OFF	
(LA) Black	LA LEAD OFF	LEADSWITCH TO LEAD II
(RA) White	RA LEAD OFF	LEADSWITCH TO LEAD III

NOTE: The Green lead (RL) does not display a lead off message. Verification is not required.

9. Check the following lead configurations for following items:
   - Heart rate 60 ±3 BPM,
   - Correct waveforms.



10. Set the Dynatech MED SIM300 to a heart rate of 300BPM. Verify that the ECG HR reads *300BPM ±1BPM*.

11. Turn off the simulator and verify that the message *ECG LOST* appears at the top of the window.

12. Turn the simulator back on and set the simulator for 60BPM, LEAD II and verify that the gain settings are effective at x.5, x2, and x4 for 1mv ECG input.

13. Select **ECG** on the simulator, select **base**, then **BPM**, and **60**. This gives a normal sinus rhythm at this time. Select **ECG**, then **ARRH**, then **VNT2**, and then **VFIB**. The unit should detect an erratic baseline and display the message *ECG LOST*.

Temperature Verification

1. Measure room air temperature using each probe (1 and 2) and compare the output with a calibrated thermocouple. Verify each reading is within 0.5°F of each other and the thermocouple.
2. Place each probe and the thermocouple probe between an index finger and a thumb. Verify each reading is within 0.5°F of each other and the thermocouple.

Anesthesia/CO_2/O_2 Verification

Turn on the monitor and then rotate the menu knob to select the *PARAMS* window. Go to *Other Params Menus* and select *Gas Menu*. Select the unit of measure for *PERCENT* under *CO2*.

PNEUMATIC LEAKAGE TEST

1. Power cycle the monitor. After the monitor has completed the auto-cal, connect a vacuum gauge to the sample line of the water trap. Verify that the vacuum at the sample line is greater than 10 inches of mercury within 30 seconds.

OCCLUSION TEST

1. With the vacuum gauge still attached, verify the *OCCLUSION* message appears on the screen and that the pump runs at a higher speed to clear the occlusion.

EXHAUST FLOW VERIFICATION

1. Verify that the exhaust flow is fluctuating approximately 100 mL/min – 200mL /Min.
2. Obstruct the exhaust port (pinch tubing or cover the port with a finger) and verify the *AGT: NO EXHAUST* message appears.

VERIFY EXPIRED O_2

1. Run 5% CO_2, 95%N_2 mixture connected via a breathing simulator to the sample line. Verify the expired O_2 is less than 1%.

NOTE: If any verification fails, contact MEDRAD service.

Electrical Safety Testing (Power Supply)

Perform this test each time you open the power supply housing.

⚠WARNING⚠

- Shock Hazard! Because dangerous and lethal voltages are present during the withstanding voltage, leakage, and ground continuity test, all leakage and voltage testing must be done with the monitor housing in place. For complete information about the proper operating and safety procedures, refer to the ***Veris** 8600 Patient Monitor Operator's Manual.*

Verification of Fuses and Assembly

1. Using a small flat head screw driver, remove fuse drawer with a prying motion. Inspect the fuse rating on each fuse of the AC inlet. Replace if not specified rating (3.15A @ 250V).

Leakage Test Equipment and Setup

Perform all testing with the cover on. The following test requires a Dynatech 232D leakage tester or equivalent.

1. Perform a self-test, if applicable, on the DYNATECH 232D by plugging it into 110 VAC outlet. Turn on the leakage tester. Set the mode switch to self test. Display should read 1000 ±20 and the *CURRENT SOURCE ACTIVE* lamp should be on.

⚠CAUTION⚠

- If these conditions are not met, do not continue with this test.

2. Set the mode switch on the Dynatech 232 to **L1-L2** (line voltage). The display should read the line voltage ±10%. Set the mode switch to **L1-GND**. The display should read no more than 5% of **L1-L2** on a grounded power system. Set the mode switch to **L2-GND**.

   NOTE: This should read about the same as the **L1-L2** reading for a grounded system.

Leakage Test Procedure

The monitor must be powered up during all of the isolation tests.

1. Verify Normal Earth Leakage is <0.25 mA at 120VAC line voltage.
2. Verify Earth Leakage with Reverse Polarity is <0.5mA at 120VAC line voltage.
3. Verify Earth Leakage with Open Neutral is <0.5mA at 120VAC line voltage.
4. .Verify Earth Leakage with Reversed Polarity and Open Neutral is <0.5mA at 120 line voltage.
5. Verify Normal Enclosure Leakage is <0.05mA at 120VAC line voltage.
6. Verify Enclosure Leakage with Reversed Polarity is <0.25mA at 120VAC line voltage.
7. Verify Enclosure Leakage with Open Neutral is <0.25mA at 120VAC line voltage.

8. Verify Enclosure Leakage with Reversed Polarity and Open Neutral is <0.25mA at 120VAC line voltage.
9. Verify Enclosure Leakage with Open Earth Ground is <0.25mA at 120VAC line voltage.
10. Verify Enclosure Leakage with Reversed Polarity and Open Earth Ground is <0.25mA at 120VAC line voltage.

Output Verification

1. Apply 120VAC to the AC inlet using a standard AC power cord.
2. Measure at the DB-15 connector.
   a. Measure between pins 1 and 8. Verify that the voltage is 16.5VDC (±0.2VDC).
   b. Measure between pins 2 and 9. Verify that the voltage is 16.5VDC (±0.2VDC).
   c. Measure between pins 3 and 10. Verify that the voltage is 16.5VDC (±0.2VDC).

   NOTE: If 0V is the measured output, this would indicate an open wire or miswired connection.

ECG Module Verification

Equipment Needed

- 1 ECG patient simulator (Fluke 217A or equivalent)
- 1 5-Lead ECG Leadset (3010473)
- 1 ECG fiber optic cable (3005290)
- 1 Hi-Pot Tester
- 1 100K-Ohm resistor with 2 8x32 screws and nuts.

Verification of ECG Module Charger

1. Connect the ECG moldule to an ECG Module Charger and verify that the green LED flashes slowly with an approximately 50% duty cycle.
2. Turn on the ECG moldule and verify that the fiber optic transmitter lights for approximately 1 second.
3. Turn off the ECG module and disconnect it from the charger.

Risk Current Testing

1. Turn on the ECG module and record and verify the following voltages.

   NOTE: Verify that all switches not specified as positive are negative.

Positive	Tied to	Range
RA	LA, LL, V, RL	1.75 to 2.75mV
LA	RA, LL, V, RL	1.75 to 2.75mV
LL	RA, LA, V, RL	-5.50 to –7.50mV
V	RA, LA, LL, RL	1.75 to 2.75mV
RL	RA, LA, LL, V	-0.1 to 0.1mV

ECG Display Testing

1. Remove the ECG module safety tester and connect an ECG patient simulator by using the 5-Lead ECG Leadset.
2. Set the ECG patient simulator to the following settings: Normal rhythm, 60bpm, 1mV amplitude
3. Set the ***Veris*** monitor to display ECG Leads II, III, and V.
4. Confirm that all three leads display as described.

   NOTE: The ECG module needs to be on for this test.

   Verify that Lead II displays a waveform with normal rhythm at 60bpm.

   Verify that Lead III displays a waveform about 1/3 of the size of Lead II with a normal rhythm at 60bpm.

   Verify that Lead V displays a waveform with the opposite polarity of Lead II and a normal rhythm at 60bpm.

ECG Lead-Off Testing

1. Remove the LA connection from the ECG module.
   a. Verify that the message *ECG: LA LEAD OFF* appears.
   b. Verify that the Lead III and Lead V traces becomes flat.
   c. Verify that the Lead II trace is unaffected.
   d. Replace the LA connection.
2. Remove the RA connection from the ECG module.
   a. Verify that the message *ECG: RA LEAD OFF* appears.
   b. Verify that the Lead II and Lead V traces becomes flat.
   c. Verify that the Lead III trace is unaffected.
   d. Replace the RA connection.
3. Remove the V connection from the ECG module.
   a. Verify that the message *ECG: V LEAD OFF* appears.
   b. Verify that the Lead V trace becomes flat.
   c. Verify that the Lead II and Lead III traces are unaffected.
   d. Replace the V connection.
4. Remove the LL connection from the ECG module.
   a. Verify that the message *ECG: LEADS OFF* appears.
   b. Verify that all lead traces become flat.
   c. Replace the LL connection.
5. Remove all test connections from the ECG module.